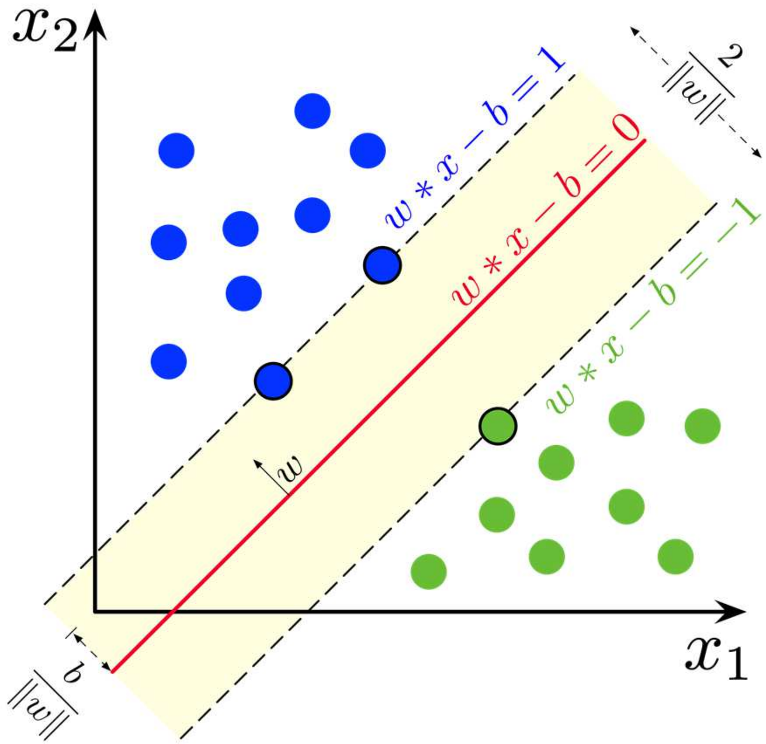
Labor_09

SUPPORT VECTOR MACHINE

SVM idea



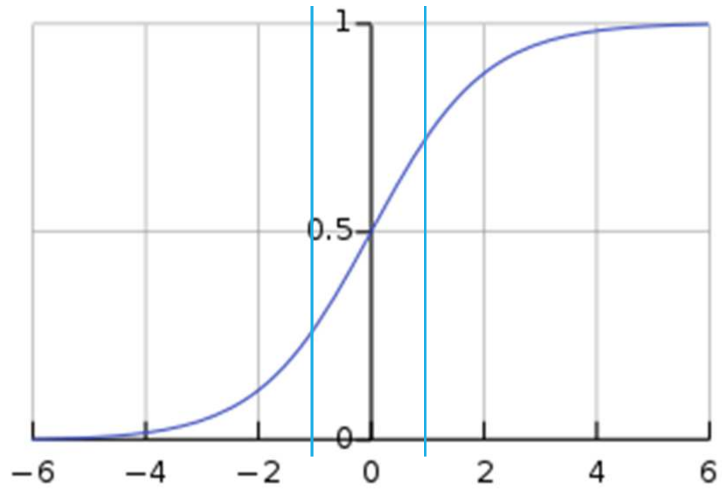
Support Vector Machine

$$h_w(x) = \frac{1}{1+e^{-Xw}}$$

$$h_w(x) = g(Xw)$$

$$h_w(x) = g(z)$$

$g(z) \geq 0.5$
when $z \geq 0$



If $y = 1$, we want $Xw \geq 1$ (not just ≥ 0)
If $y = 0$, we want $Xw < -1$ (not just < 0)

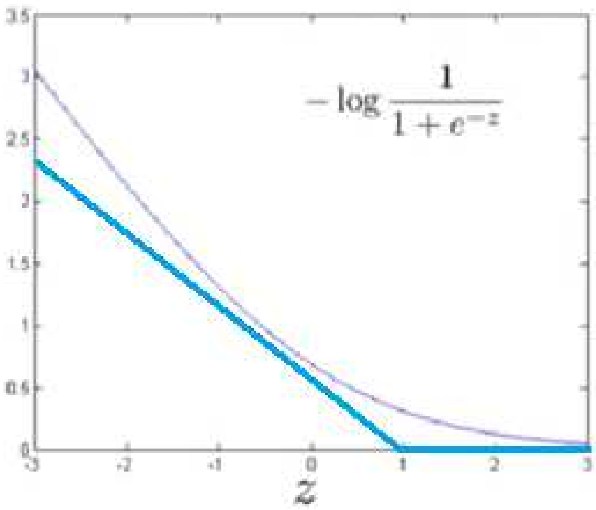
Cost function – Logistic Regression

$$C = -(y \cdot log(h_w(x) + (1 - y) \cdot log(1 - h_w(x)))$$

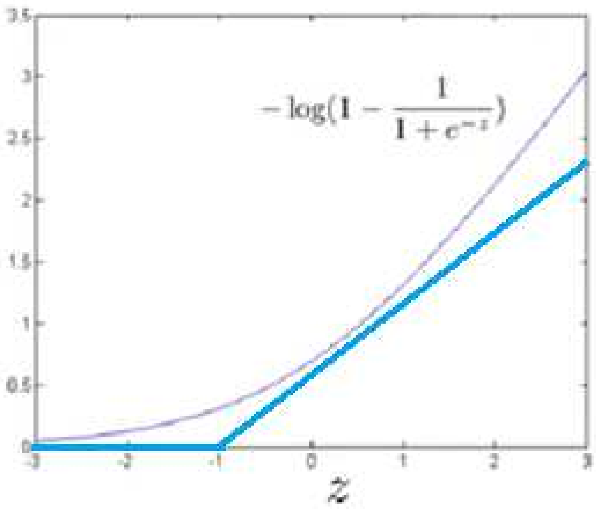
$$C = -y \cdot log(h_w(x) - (1 - y) \cdot log(1 - h_w(x))$$

$$h_w(x) = \frac{1}{1 + e^{-Xw}} = \frac{1}{1 + e^{-z}} = g(z)$$

$cost_1(z)$



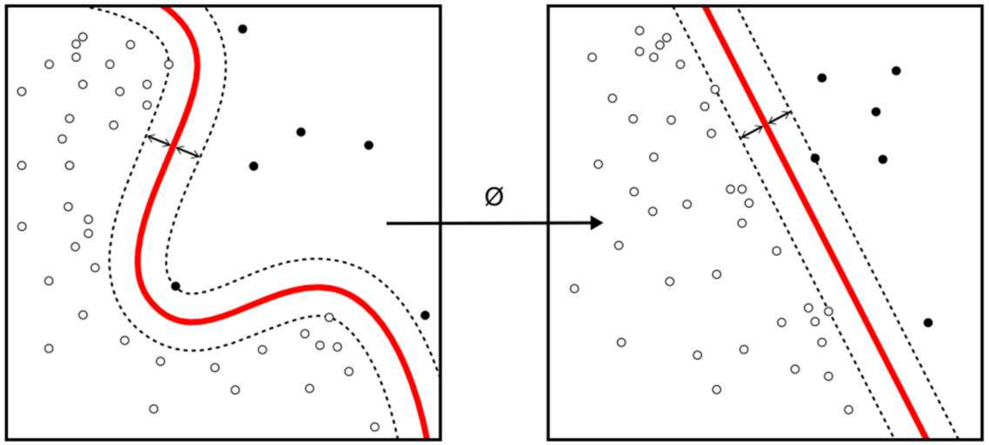
$cost_0(z)$



Cost Function - SVM

$$min_w \frac{1}{m}\Big[\sum_{i=1}^{m} y^{(i)}\cdot(-log(h_w(x^{(i)})+(1-y^{(i)}))\cdot(-log(1-h_w(x^{(i)})))\Big]+\frac{\lambda}{2m}\sum_{j=1}^{n} w_j^2$$

$$min_w\ C\Big[\sum_{i=1}^{m} y^{(i)}\cdot cost_1(h_w(x^{(i)})+(1-y^{(i)}))\cdot cost_0(1-h_w(x^{(i)})))\Big]+\frac{1}{2}\sum_{j=1}^{n} w_j^2$$



Gaussian Kernel

$$K_{gaussian}(x^{(i)}, x^{(j)}) = \exp\left(-\frac{\|x^{(i)} - x^{(j)}\|^2}{2\sigma^2}\right) = \exp\left(-\frac{\sum_{k=1}^{n}(x_k^{(i)} - x_k^{(j)})^2}{2\sigma^2}\right)$$